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MILITARY MUNITIONS RESPONSE PROGRAM

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NON-TIME-CRITICAL REMOVAL ACTION
MRS-MOCO.2 NOI REMOVAL AREA (PHASES 1 AND 2)
AFTER-ACTION REPORT

6 June 2006

prepared for

U.S. Army Corps of Engineers
Sacramento District

prepared by

PARSONS

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for
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Non-Time Critical Removal Action
MRS-MOCO.2 NOI Removal Area (Phases 1 and 2)
After-Action Report

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ACRONYMS AND ABBREVIATIONS

AAR	after-action report
ARA	analog removal area
AT	antitank
bgs	below ground surface
BLM	Bureau of Land Management
BRAC	base realignment and closure
DQO	data quality objective
DGM	digital geophysical mapping
EM	electromagnetic
ft	foot
FVF	field variance form
GPS	global positioning system
GUI	graphical user interface
HE	high explosive
HMP	installation-wide multispecies habitat management plan
MEC	munitions and explosives of concern
mm	millimeter
MOCO.2	parcel 2 in Monterey County
MPPEH	material potentially presenting an explosive hazard
MRS	munitions response site
mV	millivolt
NCR	nonconformance report
NOI	notice of intent
NTCRA	non-time-critical removal action
PDA	personal digital assistant
PSP	pierced-steel-plank
PWP	programmatic work plan
QA	quality assurance
QC	quality control
QCM	quality control manager
RTK	real-time kinematic
SCA	special-case area
SOP	standard operating procedure
SSWP	site-specific work plan
TBD	to be determined
TCRA	time-critical removal action
TIP	technical information paper

USACE	U.S. Army Corps of Engineers
UXO	unexploded ordnance
UXOQCS	UXO QC specialist
WBS	work breakdown structure

DEFINITIONS AND TERMS

analog removal area (ARA)	Surveyed area where vegetation or terrain prevents access by geophysical survey equipment, thus requiring anomaly detection with an analog instrument. Source: 1
anomaly	Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and non-ferrous material at a site (i.e., pipes, power lines, etc.). Source: 2
blow-in-place (BIP)	To destroy MEC, by use of explosives, in the location the item is encountered. Source: 3
cultural debris	Debris found on operational ranges or munitions response sites that is not related to munitions or range operations. It may be removed to facilitate a range clearance or munitions response. Such debris includes but is not limited to rebar, household items, fence posts, fence wire, and automobile parts and automobiles that were not associated with range targets. Source: 4
digital geophysical polygon	An area where geophysical data processors cannot distinguish individual anomalies within the data collected, thus requiring anomaly detection with an analog instrument. This could also occur after analog removal if the Schonstedt did not detect a clutter of nonferrous metals or if an identified cluster of small ferrous metal pieces was left in place to determine whether the EM-61 could "see through" the clutter, avoiding excessive, non-essential excavations during analog removal. Source: 1
digital geophysical survey	Process by which digital geophysical detection equipment is used to identify and record potential locations of military munitions and create a digital map of an area. Source: 1
discarded military munitions (DMM)	Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations. Source: 5
grid	A subdivided work area in a site, usually 100 ft by 100 ft. Grids are surveyed and marked with wooden stakes before removal work begins in a site. Grids are numbered sequentially using an alpha-numeric system. Source: 1

grid sampling Geophysical investigation and excavation of selected anomalies over a percentage of a site to provide data for characterizing the site. Source: 1

Impact Area 8,000-acre area within the southwest portion of the former Fort Ord containing numerous firing ranges previously used for military training activities involving live ammunition. The Impact Area is bordered by Eucalyptus Road, General Jim Moore Boulevard, South Boundary Road, and Barloy Canyon Road to the north, west, south, and east, respectively. Source: 1

magnetometer An instrument measuring the strength of a magnetic field that is used to detect buried iron and other metal objects. Source: 1

material potentially presenting an explosive hazard (MPPEH) Material potentially containing explosives or munitions (e.g. munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris); or material potentially contaminated with sufficient concentration of explosives to present an explosive hazard (e.g., equipment, drainage systems, holding tanks, piping, or ventilation ducts that were associated with munitions production, demilitarization, or disposal operations). Excluded from MPPEH are munitions within DoD's established munitions management system and other hazardous items that may present explosion hazards (e.g., gasoline cans, compressed gas cylinders) that are not munitions and are not intended for use as munitions. Source: 4

military munitions All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the Department of Defense, the Coast Guard, the Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof. Source: 6

mortar Mortars range from approximately 1 inch to 11 inches in diameter and can be filled with explosives, toxic chemicals, white phosphorous, or illumination flares. Mortars generally have thinner metal casing than projectiles but use the same types of fuzing and stabilization. Source: 7

munitions and explosives of concern (MEC) Military munitions that may pose unique explosives safety risks, including UXO, discarded military munitions, or munitions constituents present in high enough concentrations to pose an explosive hazard. Source: 8

munitions constituents Any materials originating from unexploded ordnance, discarded military munitions, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. Source: 5

munitions debris Remnants of munitions (e.g., penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal. Source: 4

munitions response Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by unexploded ordnance, discarded military munitions, or munitions constituents, or to support a determination that no removal or remedial action is required. Source: 8

munitions response area (MRA) Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples are former ranges and munitions burial areas. An MRA comprises one or more munitions response sites. Source: 8

munitions response site (MRS) A discrete location within a munitions response area (MRA) that is known to require a munitions response. Source: 8

projectile Object projected by an applied force and continuing in motion by its own inertia. Includes bullets, bombs, shells, grenades, guided missiles, and rockets. Source: 7

range-related debris Debris, other than munitions debris, collected from operational ranges or from former ranges (e.g., target debris, military munitions packaging, and crating material). Source: 4

special-case area (SCA) An area in an MRS in which MEC removal cannot be completed within the scope of work due to metallic clutter or obstructions that compromise instrument performance or technician safety or because the removal process would cause a serious adverse impact to the habitat. Source: 1

subsurface removal Removal of MEC located below the ground surface by using geophysical instruments to detect and identify possible locations of OE and then digging at those locations. Source: 1

surface removal — Removal of MEC from the ground by visually identifying items on the surface and using a magnetometer to detect items when the surface is covered by debris (e.g. wood chips, leaves). Source: 1

unexploded ordnance (UXO) — Military munitions that have been primed, fuzed, armed, or otherwise prepared for action; have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material; and remain unexploded whether by malfunction, design, or any other cause. Source: 6

Sources:

1: Nonstandard definitions developed to describe items, conditions, and procedures specific to Fort Ord Military Munitions Response Program

2: Engineering and Design – Ordnance and Explosives Response, EM 1110-1-4009, USACE (23 June 2000).

3: UXO Safety Education Program: Glossary of Terms, DENIX.

4: Memorandum for the Assistant Chief of Staff for Installation Management: Munitions Response Terminology (21 April 2005).

5: 10 USC 2710(e)

6: 10 USC 101(e)

7: Compendium of Department of Defense (DoD) Acronyms, Terms, and Definitions: The Interstate Technology and Regulatory Council (ITRC) Work Group (Unexploded Ordnance Team) (December 2000).

8: 32 CFR 179.3.

CHAPTER 1
OVERVIEW

1.1 PURPOSE

From 1999 to 2001, sampling and removal activities were performed on the Munitions Response Site (MRS) in parcel 2 in Monterey County (MOCO.2). During that fieldwork, numerous munitions and explosives of concern (MEC) were found on the surface or within two feet (ft) below the surface. Combined with trespassing incidents that occurred despite security measures and the close proximity of the site to homes, schools, and recreational lands (Map 1, Appendix A), the Army determined that the presence of MEC in MRS-MOCO.2 posed a threat to human health (public safety) or welfare or to the environment.

To address this threat, the Army issued a notice of intent (NOI) [Ref. 1] to the public and regulatory agencies, designating the 33-acre northern portion of the 59-acre MRS-MOCO.2 site for a non-time-critical removal action (NTCRA). The NOI listed the following actions to be taken under the NTCRA:

1) Detect anomalies with analog Schonstedt GA-52Cx magnetometers and excavate them to depth;

2) Digitally map the post-removal site conditions by geophysically surveying the site, and then investigate and resolve any anomalies detected by the survey; and

3) Conduct quality control (QC) and quality assurance (QA) inspections.

The analog removal to depth, digital mapping operations, and QC/QA inspections were conducted on MRS-MOCO.2 from July to November 2003, completing Phase 1. The draft final technical information paper (TIP) reporting Phase 1 activities and results was made final by letter on 24 July 2004; it is incorporated into this after-action report (AAR) as Appendix B. Phase 2, conducted from January 2005 to December 2005, involved resolving remaining special-case areas (SCAs) identified in the Phase 1 TIP. This AAR describes the Phase 2 actions and provides the results of those actions.

Approximately six acres of the removal area were designated SCAs during Phase 1 due to obstructions that compromised instrument performance or technician safety. The immediate threat posed to the public by these SCAs had been mitigated by removing the MEC on the surface during the Phase 1 NTCRA. Phase 2 addressed the potential subsurface MEC in the SCAs by performing subsurface removal after removing the obstructions or developing methods to compensate for their effects on instruments, further reducing the risk of encountering MEC in those areas.

1.2 SCOPE

See Appendix B Section 1.2 for a description of activities performed during Phase 1 of the MRS-MOCO.2 NTCRA. Phase 2 of the MRS-MOCO.2 NTCRA involved activities to further reduce any threat to public safety in the SCAs, based on recommendations from the Phase 1 TIP. These recommendations included the following actions:

- Remove the metallic fence along Eucalyptus Road and the Ranges 44 and 45 gates, which interfered with the analog and digital instruments within 15 feet; perform analog removal, digital mapping, and QC inspection along a 25-ft-wide corridor; and replace the fence and gates.
- Remove structures and debris piles from asphalt-covered areas, digitally survey these areas with an EM61-MK2, excavate anomalies potentially representing MEC, and perform digital QC inspection.
- Remove the two latrine structures in the NOI area; investigate the pits in accordance with the latrine clearance standard operating procedure (SOP) in Appendix G of the programmatic work plan (PWP) [Ref. 2]; and perform analog removal, digital mapping, and QC inspection over the areas affected by the latrines.
- Deconstruct the berm in the southernmost portion of the NOI removal near the Range 45 pad using a scraper, until a geologist determines that the level of the berm matches the existing terrain or that the native soil levels have been reached, then perform analog removal, digital mapping, and QC inspection.
- Wrap and remove the transite (asbestos-containing) pipes encountered in Ranges 44 and 45 (which were temporarily relocated to Range 44), transport them offsite for disposal; then perform the removal and QC processes on grid C2B9F1 in Range 44.

CHAPTER 2
SITE BACKGROUND AND PHASE 1 REMOVAL ACTIVITIES

2.1 FORMER FORT ORD

2.1.1 LOCATION

The former Fort Ord occupies approximately 28,000 acres adjacent to Monterey Bay (a national marine sanctuary) and the cities of Marina, Seaside, Sand City, Del Rey Oaks, and Monterey. State Highway 1 crosses the western section of Fort Ord, separating the beachfront from most of the installation. Laguna Seca Recreational Area and the Toro Regional Park border former Fort Ord to the south and southeast, respectively, as do several small communities, such as Toro Park Estates and San Benancio (Map 1, Appendix A).

2.1.2 HISTORY

Fort Ord became a training installation in 1917. Army infantry, cavalry, and field artillery units trained there for World War I, World War II, Korea, Vietnam, and Desert Storm. The 1991 base realignment and closure (BRAC) list included Fort Ord, which closed in 1994. Since the BRAC listing and closure, MEC investigation and clearance actions have been performed and documented to address explosive safety hazards and to prepare Fort Ord property for transfer and reuse.

2.1.3 TERRAIN

The topography at the former Fort Ord is predominantly dune sand deposits with elevations ranging from sea level to approximately 800 ft. The terrain includes flat areas, shallow grades, and moderate-to-steep slopes. In the southeastern portion of the former fort, the terrain has well-defined, eastward-flowing drainage channels within narrow, moderately to steeply sloped canyons. In the western and northern portion, the terrain slopes gently to the west and northwest, draining toward Monterey Bay. Within MRS-MOCO.2, the terrain consists of gently rolling hills.

2.1.4 VEGETATION

The vegetation at the former Fort Ord includes 12,500 acres of maritime chaparral (mostly in the south-central portion), 5,000 acres of oak woodlands, and 4,500 acres of grasslands (mostly in the southeastern and northern portions). Within MRS-MOCO.2, the vegetation before clearance was primarily maritime chaparral with scattered stands of oak trees.

2.1.5 GEOLOGY

Fort Ord is at the transition between the mountains of the Santa Lucia Range and the Sierra de la Salinas to the south and southeast, respectively, and the lowlands of the Salinas River Valley to the north. For the MRS-MOCO.2 NCTRA, the most important geological issue is the significant effects of the Santa Margarita Formation on the geophysical survey process. Iron-cemented sandstone and magnetic concretions in this formation cause anomalies in the geophysical data. Compared to magnetic methods, electromagnetic (EM) methods are generally less significantly affected by these concretions. When buried, the concretions can cause effects ranging from minor to severe, depending on the soil overburden thickness and the concentration of the concretions.

2.2 MRS-MOCO.2

2.2.1 LOCATION

MRS-MOCO.2 occupies the northernmost portion of the Impact Area, which is in the south-central section of the former Fort Ord. The site is bordered by Eucalyptus Road to the north, MRS-SEA.4 to the west, and MRS-Ranges 43-48 to the south and southeast. The site is close to residential communities (the city of Seaside and the Fitch Park, Marshall, and Stilwell housing areas), schools (Fitch Middle School, Marshall Elementary School, and Cypress Grove Charter High School at the Stilwell Elementary School location), and recreational facilities (Bureau of Land Management [BLM] lands). Map 1 in Appendix A shows the location of MRS-MOCO.2 within the Impact Area and the former Fort Ord, and the close proximity of the site to the residential communities, schools, and recreational lands.

2.2.2 DESCRIPTION

2.2.2.1 Boundaries

MRS-MOCO.2 is a 59-acre site that was identified by transfer parcel boundaries and is coincident with reuse parcel E21b.3 [Ref. 3].

The removal of MEC at MRS-MOCO.2 was originally planned as part of the MRS-Ranges 43-48 interim action, which required a detailed evaluation of vegetation clearance alternatives. As a result of regulatory agency and public review, the 33-acre northern portion of MRS-MOCO.2 identified by the NOI was excluded from the process because (1) its vegetation could be cut and (2) it is proposed for future development. The site boundary and the parcel boundary were later modified to delineate the 33-acre development area that was subject to the MRS-MOCO.2 NTCRA; the remaining 26 of the 59 acres (including the Range 45 firing positions and most of the Range 45 pad) was assigned to the MRS-Ranges 43-48 interim action. Results of the MRS-Ranges 43-48 interim action, including the work on the southern 26 acres of MOCO.2 not included in the MRS-MOCO.2 NOI, are in the MRS-Ranges 43-48 Interim Action Technical Information Paper scheduled for completion in August 2006. The boundaries of MRS-Ranges 43-48, MRS-MOCO.2, and the 33-acre NOI removal area are shown in Map 1 in Appendix A. Map 2 in that appendix shows the site in greater detail, including natural features and human artifacts such as roads and structures.

2.2.2.2 Natural Resources

Vegetation

Before vegetation clearance operations were conducted on the removal area, maritime chaparral with scattered stands of oak trees covered approximately 30 acres of the site, with asphalt and a few barren areas near Range 45 characterizing the other three acres. Fuel break maintenance work and preparatory work for the Ranges 43-48 prescribed burn cut approximately 26 acres of the maritime chaparral vegetation. The remaining four acres, in the southernmost portion of the removal area, were cut to support this NTCRA.

Plant Species of Concern

The plant species of concern inhabiting MRS-MOCO.2 before Phase 1 include sandmat manzanita, Monterey ceanothus, Seaside birdsbeak, and Eastwood's golden fleece, which are listed in the Installation-wide Multispecies Habitat Management Plan (HMP) [Ref. 4]. These plants associated with maritime chaparral are considered endangered, threatened, or rare by the federal government or the state of California. Other HMP-listed plant species that may have been present include Monterey spineflower and sand gilia. No species of concern were encountered during Phase 2 activities.

Animal Species of Concern

During Phase 1 anomaly excavations, one California black legless lizard was encountered in grid C2B7D8. No species of concern were encountered during Phase 2 activities.

2.2.2.3 Security

Site-security measures include four-strand barbed-wire fence reinforced with concertina wire, locked chain-link gates with concertina wire on the bottom to block the access roads into the site, warning signs posted every 500 ft along the fences, and roving patrols by the Presidio of Monterey Police Department. The original concertina wire 10 to 15 ft inside the site was removed during Ranges 43-48 site preparation activities.

Eucalyptus Road is usually open to hikers, bikers, and joggers; however, vehicle access is restricted by barriers at the General Jim Moore Boulevard / Eucalyptus Road and Parker Flats Road / Eucalyptus Road intersections and by barricades marked with "road closed" signs at the Parker Flats Cut Off / Eucalyptus Road intersection. During field operations, gate barricades were placed at the intersections of Eucalyptus Road / Austin Road, Eucalyptus Road / Parker Flats Road, and Parker Flats Cutoff Road / Parker Flats Road. Additional fence barricades were placed at primary bike and pedestrian trails along Eucalyptus Road. The gates placed at the road intersections were secured each workday morning and opened at the end of each workday. While these site-security measures restricted access into the site, a few trespassing incidents into the exclusion zone occurred when work was in progress. In these cases, work was immediately stopped until the hikers or bicyclists were met and escorted from the exclusion zone The TIP (Appendix B) discusses incidents during Phase 1.

2.2.3 MEC History

2.2.3.1 Items Found or Used on MRS-MOCO.2

MRS-MOCO.2 contains the firing lines of Ranges 44 and 45 (Map 2, Appendix A), where training activities involving live ammunition occurred. Range 44 was an antitank (AT) weapons range and Range 45 was a 40-millimeter (mm) grenade range [Refs. 5, 6, and 7]. Section 2.2.3.1 of the Phase 1 TIP lists the prior use of these ranges and the items previously found or used on them.

2.2.3.2 Previous Site Investigations/Activities

Work in MRS-MOCO.2 before Phase 1 included grid sampling, fuel break maintenance, a surface time-critical removal action (TCRA), and preparatory work for the Ranges 43-48 prescribed burn. The TIP describes each activity and the amount of MEC encountered (see

Appendix B). Figure 2-2 in the TIP displays where items were encountered in the removal area during these previous activities, as well as the locations of the range fans, previously sampled or cleared grids, roads, and fuel breaks.

2.2.4 PHASE 1 ACTIVITIES

The MRS-MOCO2 TIP (Appendix B) provides a detailed discussion of the Phase 1 munitions response work completed on the site. The TIP also identifies the SCAs that were not completed under Phase 1 (totaling approximately six acres) and recommends cleanup solutions for Phase 2. The following sections summarize the Phase 1 activities.

2.2.4.1 Site Preparation

Preparation for the removal activities of Phase 1 included a geophysical walk-through of the removal area, surveying and marking the removal area boundaries, vegetation clearance, and grid installation. Chapter 3 of the TIP, reproduced in Appendix B of this AAR, discusses those actions.

2.2.4.2 Analog Removal

From July to September 2003, unexploded ordnance (UXO) teams conducted the Phase 1 analog removal to depth over the MRS-MOCO.2 NOI removal area, digging at each spot where an anomaly was detected until its source was located and removed. The TIP, reproduced in Appendix B of this AAR, includes detailed discussion in Chapter 4 of QC/QA item seeding and recovery, anomaly detection and removal, types of MEC encountered, MEC demolition, handling of munitions debris encountered, military munitions burial sites and their contents, and SCAs.

2.2.4.3 Digital Geophysical Mapping

From August to November 2003, Phase 1 digital mapping operations conducted in the MRS-MOCO.2 NOI removal area mapped and documented the site conditions after analog removal. These operations also located and identified geophysical anomalies potentially representing MEC in the subsurface. Chapter 5 of the TIP, reproduced in Appendix B of this AAR, describes the instruments used to collect data as well as the storage, processing, and analysis of that data. The Phase 1 TIP also explains how teams used the data to determine which anomalies needed intrusive investigation (digging) and presents the results of those investigations. A synopsis of QC/QA briefly discusses seeded items and checks of geophysical operations, including data acquisition/processing and anomaly reacquisition. Figure 5-7 in the TIP shows the status of seeded items, TIP Figure 6-1 shows QC-2 survey results, and TIP Figure 6-2 shows QC-2 survey anomaly excavation results. The U.S. Army Corps of Engineers (USACE) accepted 99 grids at the end of Phase 1.

2.2.5 SUMMARY OF RECOMMENDED CLEANUP SOLUTIONS

The Phase 1 TIP categorized SCAs as fence, asphalt, latrine, berm, and asbestos pipe and recommended cleanup solutions for these portions of the site that compromised instrument performance or technician safety during the Phase 1 field activities, as summarized in Section 1.2 of this AAR. Most of this work was done during Phase 2, except for eight SCAs:

- SCAs 1 and 6 were two locations in grid C2B8D3 in which extensive rat nests presented a hazard for instrument operators. The nests were removed and the areas received analog and digital removal. The special request for removal work at this area was completed and was verified by the UXOQC on 21 July 2004.
- SCA 23, in grid C2B8D3 , was a retaining wall containing steel lag bolts that interfered with instrument operation in part of grid C2B8D4. The grid was accepted by QC and QA on Nov 17, 2005.
- SCAs 24 and 25 were two pit latrines, one in grids C2B8J4 and C2B8I4 and the other in grids C2B8F5. Under a separate scope of work (Debris Pile Removal at MRS-MOCO.2), the aboveground wood structure portions of the two latrines were removed, leaving concrete- or wood-lined latrine pits in place [Ref. 8]. In accordance with the latrines SOP and Cost Estimate ORD041 (which in December 2004 clarified the scope of work for various SCAs in MRS-MOCO.2), the pits of the latrines were cleared of any visible liquid, visually inspected for MEC, and then backfilled with clean material, leaving the concrete bases and pit walls in place. Although QC and QA were performed throughout the remainder of the three affected grids up to these obstacles, the areas of the latrines could not receive final QC and QA because the steel reinforcement in the concrete interferes with operation of the Schonstedt GA-52Cx magnetometer and the EM61-MK2 electromagnetic sensor. The three grids therefore received "To Be Determined " (TBD) status, meaning that future intrusive work should be supported by removal of the obstacles followed by analog removal and digital geophysical operations.
- SCAs 27, 28, and 29 involve utility poles and anchors in grids C2B7I4, C2C8A5, and C2C8B3. Because the poles support telephone and/or high-voltage cables, they were left in place. QC and QA were performed through the remainder of the three affected grids to within six ft of these obstacles, at which point interference became too high for the instruments to operate effectively.

The remaining SCAs recommended by the Phase 1 TIP for cleanup were the focus of Phase 2 activities. For Phase 2, SCAs were placed into categories that better described area characteristics:

- Culverts, pipes, and buried steel
- Asphalt and concrete features
- Range 45 pad, berm, and firing positions
- Fence
- Processing areas
- Miscellaneous areas.

In addition to these areas where work was performed as recommended in the MRS-MOCO.2 Phase 1 TIP, Phase 2 work also took place in additional areas identified after the Phase 1 TIP was finalized, primarily where the target processing areas extended slightly beyond the asphalt pads at SCAs 30 and 31 (see Section 4.2) and where culverts, pipes, and buried steel were removed (see Section 4.3). Map 3 in Appendix A shows the SCA locations where removal action was performed during Phase 2, and Table 2-1 identifies the features and categories associated with those SCAs addressed in Phase 2.

Table 2-1 — Special Case Area Features

SCA ID	SCA Feature	SCA Category	Area (ft^2)	Acreage
2	Anomaly on steep hillslope	Miscellaneous Areas		
3	Surface debris	Miscellaneous Areas	861	0.02
4	Transite pipe	Miscellaneous Areas		
5	PSP mat	Culverts, Pipes, and Buried Steel	1,200	0.03
7	PSP Mat; steep slope	Culverts, Pipes, and Buried Steel		
8	Culvert; open hole	Culverts, Pipes, and Buried Steel	106	0.002
9	Asphalt: roadways and pads	Asphalt and Concrete Features	55,075	1.3
9a	Operational buffer: roadways	Asphalt and Concrete Features	24,394	0.6
10	Asphalt: Range 45 pad	Range 45 Pad, Berm, and Firing Positions	44,621	1
11	Roadway	Asphalt and Concrete Features		
12	Concrete drain	Asphalt and Concrete Features	290	0.01
13	Concrete stairs	Asphalt and Concrete Features	2,783	0.06
14	Steel pipe under road	Culverts, Pipes, and Buried Steel		
15	Culvert	Culverts, Pipes, and Buried Steel		
16	Culvert	Culverts, Pipes, and Buried Steel	92	0.002
17	Culvert	Culverts, Pipes, and Buried Steel	66	0.002
18	Culvert	Culverts, Pipes, and Buried Steel	27	0.001
19	Culvert under asphalt road	Culverts, Pipes, and Buried Steel	2,060	0.05
20	Pipe	Culverts, Pipes, and Buried Steel	37	0.001
21	PSP mat	Culverts, Pipes, and Buried Steel	595	0.01
22	Fence gate	Fence	83,499	2
26	Fill area containing metal debris	Range 45 Pad, Berm, and Firing Positions	12,148	0.28
30	Scrap processing area, concrete blocks	Processing Area	4,198	0.1
31	Range 44 scrap processing area	Processing Area	34,612	0.8
32	Range 45 pad and firing positions	Range 45 Pad, Berm, and Firing Positions	32,594	0.7

Note: Missing ID numbers correspond to items that were removed from the scope of work; the text preceding this table describes those items and their disposition.

CHAPTER 3
PHASE 2 PROCEDURES

This chapter provides a brief overview of the procedures used during the Phase 2 work, which took place from January to December 2005. These include site preparation, analog removal, digital geophysical mapping (DGM), QC, and QA. Chapter 4 describes the specific actions taken for each recommendation in the MRS-MOCO.2 Phase 1 TIP and additional work identified since the completion of Phase 1. Chapter 5 discusses the results of Phase 2 activities, including MEC and MD removal. Chapter 6 discusses quality control and quality assurance during Phase 2.

3.1 SITE PREPARATION

Site preparation for Phase 2 included removal of fences, asphalt, and culverts; scraping; and sifting. These activities generally required heavy machinery. Chapter 4 describes, among other things, the specific preparations required for each SCA.

3.2 ANALOG REMOVAL

Except where prevented by features such as pavement or interference from high-tension-wire poles and anchors, UXO teams performed analog MEC removal using Schonstedt GA-52Cx magnetometers in the SCAs addressed during Phase 2 (Photograph 1, Appendix C). UXO teams used personal digital assistants (PDAs) to capture data reflected in the grid operations records. All anomalies were excavated to depth; that is, digging continued until the anomaly source was removed. The analog removal process is described in section 2.3.7 of the site-specific work plan (SSWP [Ref. 9]).

3.3 DIGITAL GEOPHYSICAL MAPPING

DGM includes data acquisition, processing, and reacquisition. These general processes are described in section 2.3 of the SSWP [Ref. 9], but several changes were made based on field conditions encountered. These changes are described below.

3.3.1 DATA ACQUISITION

DGM was conducted over most of the MOCO.2 SCAs addressed by the Phase 2 work. However, some areas with immovable obstructions (e.g., trees) were not subjected to the DGM process. Chapter 4 describes the DGM activities conducted at each type of SCA.

3.3.2 INSTRUMENTATION

Digital mapping of SCAs in the MRS-MOCO.2 removal area used EM61-MK2 electromagnetic sensors (Photographs 2 and 3, Appendix C) and Leica SR530 real-time kinematic (RTK) global positioning system (GPS) receivers (Photograph 4, Appendix C). Handspring Visor PDAs were also used to document field activities and record the results of anomaly reacquisition (Photograph 5, Appendix C). Due to the small and irregularly shaped SCA work areas, the Dell™ Axim™ X5 PDA used during Phase 1 was not used to track coverage in real time for the Phase 2 work. Descriptions of these instruments can be found in the PWP [Ref. 2].

3.3.2.1 EM61-Mk2

All digital geophysical data acquisition during Phase 2 was conducted with EM61-Mk2 sensors. During Phase 1, the G858 magnetometer was used along the portions of the fence line within 200 ft of the power lines that run north of the site because the EM61-Mk2 was more affected by electromagnetic noise from those lines and would not meet the static noise level criteria of 2.5 millivolts (mV). During Phase 2, the EM61-Mk2 towed array system was used for the geophysical mapping over the entire fence line for three reasons:

1) It is not affected by the magnetic anomalies from pieces of asphalt that have broken off Eucalyptus Road.
2) The noise level increase caused by the power lines raised the static noise levels from approximately 1.5mV to approximately 2.5mV, not enough to significantly raise the false alarm rate or interfere with anomalies from deeper metallic objects.
3) The data could be collected more efficiently with the towed array system.

Field Variance Form (FVF) MOCO.2-0002 (Appendix D) documented the static test criteria change to 3mV for the area within 25 ft of the northern border of MOCO.2.

EM61-MK2 surveys on SCAs in MRS-MOCO.2 were done using two types of systems:

1) Individual EM61-MK2s mounted on wheeled carts that were pulled over the ground by instrument operators (Photograph 2, Appendix C) and
2) A towed-array system consisting of three EM61-MK2s linked together and placed on top of a cart pulled behind a vehicle (Photograph 3, Appendix C).

Most EM61-MK2 surveys were done with the towed array, which was used along Eucalyptus Road and along the Range 45 road. The towed array can collect three lines of data in one pass, whereas the individually operated systems can collect only one line per pass.

3.3.2.2 Leica SR530

Corrections were transmitted to the Leica SR530 from a base station GPS, which was set up approximately 3,000 ft south of the site (Photograph 4, Appendix C). The GPS antenna was positioned approximately 5.5 ft above the ground, four ft above the bottom coils of the EM61-MK2 systems. On the removal area's steepest terrain (approximately 20°), the horizontal separation between the GPS antenna and ground location directly under the center of the receiver coils was approximately 1.9 ft. These positional errors in steep areas resulted in offsets in the selected anomaly locations downslope from the actual source item location, but the reacquisition procedures compensated for these errors by searching the area within three ft of the selected anomaly location.

3.3.3 DATA PROCESSING

The data from the geophysical instruments' field data recorders was transferred at the end of each workday to desktop computers and saved on the Parsons network, which was backed up every night to safeguard the data. The Visor PDAs were synchronized at the end of each workday, directly transferring the associated data into the geophysical database.

The data collected during the geophysical surveys was preprocessed, processed, and analyzed, and individual anomalies were then selected from this processed data for investigation.

3.3.3.1 Preprocessing

During the preprocessing phase, geophysicists compared the collected data to the field notes to verify the geometry of a grid and the location of the surveyed grid corner stakes. The Parsons geophysicists also reviewed the data to verify that no data gaps were present. In addition, the geophysicists reviewed the field notes to determine whether any sources of interference were present (e.g., trees, structures, fences, metal scrap) that might have affected the data, and this information was entered into the project database.

3.3.3.2 Processing

After preprocessing, Parsons' geophysicists analyzed the geophysical data using Geosoft® Oasis montaj software. This software consists of a graphical user interface (GUI); a high-volume database; and a cross-section of built-in data import, processing, analysis, visualization, mapping, and integration capabilities. The Geosoft® platform allows a processor to edit maps interactively, apply dynamic linking to maps, and track the map creation process. Visual data links were used to connect data in the spreadsheet to profile and map views. The data were then processed by applying Geosoft® executable functions, which control the entire data processing sequence and environment. During processing, data corrections and filtering were performed on the data as necessary.

Four processing steps were applied to all datasets:

1) Coordinates translation: Translation from geographic coordinates (latitude and longitude) to the project coordinate system, NAD 83 California State Plane Zone 4 in U.S. survey feet.
2) Latency correction: Data points were shifted by 0.2 seconds to 0.5 seconds, based on the daily latency test, to accommodate different delays in data recording between the GPS and geophysical sensor.
3) Leveling: The UX-detect drift correction GX was applied to each of the four EM61-MK2 data channels using a 100-point window width and ignoring the lowest 10% and highest 30% to 50% of data values.
4) Filtering: A 12-point low-pass filter was applied to the third time gate data after leveling.

Examples of filtering and corrections include removing data spikes, making latency corrections (which compensate for time stamp delays in the data recorders), and leveling the data to a common baseline. For both the individually operated and towed-array EM61-MK2s, the raw data was leveled to bring the background to a common baseline value and allow consistent anomaly selection. The QC geophysicist checked the results of the leveling to ensure that the process was effective and did not eliminate any anomalies. Geophysical processing summary reports accompanied each data delivery, describing the processing steps performed on the data. A sample processing summary report is provided on pages 5 to 8 of the Phase 1 TIP (Appendix B of this AAR). Appendix E presents the geophysical summary reports for the raw and processed data from each grid.

3.3.3.3 Analysis

After all processing steps were complete, raw data and filtered/processed data were plotted on top of each other in profile form to view clearly how the filtering and processing steps affected the raw data. After processing, the data were gridded and contoured to prepare for the anomaly selection process.

Because background channel 3 signals are generally between 1 mV to 3 mV, targets were primarily selected above a 3-mV threshold to differentiate anomalies that appeared to represent metal objects (true positives) from instrument noise (false positives). The selected targets were stored in the database and displayed as symbols on a color contour map.

Data processors selected anomaly coordinates using the Geosoft® interactive target selection GUI and imported the coordinates into the project database. The anomaly coordinates were then exported from the project database into Leica format files, which were loaded into the GPS systems' memory cards to prepare for the anomaly reacquisition process. Areas with anomalous EM61-Mk2 responses where data processors could not confidently identify individual anomalies were designated as digital geophysical polygons and defined by four corner points on the anomaly lists and in the database. Because geophysical data processors could not distinguish individual anomalies within the data collected, anomaly detection with analog instruments was required.

Parsons maintained an average delivery schedule of three days for raw data and five days for processed data.

3.3.4 ANOMALY REACQUISITION

Field reacquisition teams attempted to redetect each of the selected anomalies to determine whether they needed to be intrusively investigated. Anomalies where the reacquisition team detected a three mV or larger peak were considered successfully reacquired. If the reacquisition team could not locate a three mV or larger peak within three ft of the selected location, the anomaly was designated as unsuccessfully reacquired.

The corners of the digital geophysical polygons were marked in the field, and all were designated for intrusive investigation. The reacquisition process is described in detail in section 5.21 of the SSWP [Ref. 9].

3.3.5 DIGITAL EXCAVATION

Each successfully reacquired anomaly and at least 10% of the unsuccessfully reacquired anomalies in each grid were excavated in accordance with the procedures described in section 2.3.9.3 of the SSWP [Ref. 9].

3.4 QUALITY CONTROL

The three-step QC process used during Phase 2 was the same as that used during Phase 1. Chapter 6 describes QC in more detail, including findings.

3.5 QUALITY ASSURANCE

The USACE QA geophysicist reviewed 100% of the geophysical data file header and data processing summary reports and a random selection of geophysical data by mapping the sum channel (sum of the first three time gate responses after leveling) and superimposing the target picks. The USACE geophysicist also conducted a 10% QA check of each SCA using a Schonstedt GA-52Cx magnetometer. All anomalies detected were immediately investigated by QA personnel. Chapter 6 describes QA in more detail.

3.6 SITE RESTORATION

Appropriate erosion control and security measures were taken after completion of QC and QA activities. Specific measures are described for the applicable SCAs in Chapter 4.

CHAPTER 4
PHASE 2 FIELD WORK

Phase 2 field activities began in January 2005 and concluded in December 2005. This effort addressed the recommendations in the MRS-MOCO.2 TIP, summarized in Section 1.2 of this AAR. The following sections in Chapter 4 describe the specific actions taken in Phase 2 to address the recommendations in the MRS-MOCO.2 Phase 1 TIP and additional work identified since the completion of Phase 1. Chapter 5 discusses the results of these Phase 2 activities, including MEC and MD removal. Chapter 6 discusses quality control and quality assurance during Phase 2.

4.1 FENCE

Approximately two acres of land along the fence line fronting MOCO.2 and Eucalyptus Road were declared an SCA due to the presence of a metal fence that precluded the use of geophysical instruments to locate subsurface anomalies (SCA 22 on Map 3, Appendix A; Photograph 6, Appendix C). Tasks at this site included

1) Site preparation,
2) Security services along the temporary fence line,
3) Surveying the area requiring clearance along the old fence line,
4) Analog removal to depth,
5) DGM,
6) Excavating anomalies identified from the digital geophysical data,
7) QC inspections,
8) QA inspections, and
9) Replacing the temporary fence with a permanent fence.

4.1.1 SITE PREPARATION

The site preparation for the fence line area involved removing the old metallic fence, which prevented effective operation of geophysical detection equipment (Schonstedt magnetometers and EM61-MK2 electromagnetic sensors) within five to15 feet of the fence. Prior to removing the old fence, a new, temporary fence consisting of orange plastic mesh supported by wooden posts was installed 30 ft south of the northern boundary of the MOCO.2 site. After installing the temporary fence, Timberline Environmental Services removed the old four-strand barbed wire and concertina fence with metal posts and two range gates. The fence and posts were disposed, but the gates were saved to be reinstalled after munitions response actions were completed along the fence line.

4.1.2 SITE SECURITY

Site security involved measures used in Phase 1, as described in Section 2.2.2.3. In addition, a private firm, First Alarm, augmented roving patrols by the Presidio of Monterey Police Department.

During Phase 2, the metal fence along Eucalyptus Road at the northern border of MRS-MOCO.2 was removed to prevent interference with digital mapping; a temporary plastic fence 30 ft inside the NOI removal area contributed to security until the metal fence was reinstalled following

MEC investigation and removal. Signs placed along the temporary fence warned the public of the potential explosive hazards in the multi-range area.

4.1.3 SURVEYING

The boundary, 100-ft-by-100-ft grids, and partial grids within the approximately two-acre area along the northern boundary of the site were marked with survey lathes.

4.1.4 ANALOG REMOVAL

The analog removal along the old fence line was performed in accordance with the procedures described in the MOCO.2 SSWP [Ref. 9]. Teams used Schonstedt GA-52Cx magnetometers along three-ft-wide lanes to detect subsurface ferrous metal objects. Excavations at the location of detected anomalies continued until the objects were removed or identified, with no maximum depth of investigation.

4.1.5 DIGITAL GEOPHYSICAL MAPPING

DGM was performed with the EM61-MK2 towed array within a 25-ft corridor along the northern boundary of the site and in the vicinity of the Ranges 44 and 45 gates.

During Phase 1 activities, the G858 magnetometer was used along the portions of the fence line within 200 ft of the power lines that run north of the site because the EM61-MK2 was more affected by electromagnetic noise from those lines and would not meet the static noise level criteria of 2.0mV. However, the EM61-MK2 towed array system was used for geophysical mapping over the entire fence line during Phase 2 for three reasons:

1) It is not affected by the magnetic anomalies from pieces of asphalt that have broken off of Eucalyptus Road.
2) The noise level increase caused by the power lines raised the static noise levels from approximately 1.5mV to approximately 2.5mV, not enough to significantly raise the false alarm rate or interfere with anomalies from deeper metallic objects.
3) Data can be collected more efficiently with the towed array system.

FVF MOCO.2-0002 documented the static test criteria change to 3mV for the area within 25-ft of the northern border of MOCO.2 (Appendix D). The EM61-MK2 data collected during Phase 2 operations are shown on Map 4 (Appendix A). Chapter 3 describes the procedures used to select and reacquire anomalies found in the digital geophysical data.

4.1.6 DIGITAL EXCAVATION

Digital excavations were conducted in accordance with the MOCO.2 SSWP [Ref. 9]. The results from these excavations in Phase 2 are summarized in section 5.3.3.

4.1.7 QUALITY CONTROL

Chapter 6 describes the three-step QC process for the MOCO.2 project. No significant metallic items were found by the QC process during Phase 2.

4.1.8 QUALITY ASSURANCE

Chapter 6 describes the USACE QA process for Phase 2 of the MOCO.2 project. The fence line area passed the QA inspection.

4.1.9 TEMPORARY FENCE REMOVAL AND INSTALLATION OF PERMANENT FENCE

Installation of the new four-strand barbed wire and concertina fence began immediately after the fence line area passed the QA inspection. The Ranges 44 and 45 gates saved from the old fence were reinstalled (Photograph 7, Appendix C). Once the entire length (approximately 3,400 ft) of fence and gates were in place, the temporary fence was removed.

4.2 PROCESSING AREAS

Processing of heavy targets from Ranges 43-48 and the Watkins Gate Burn Area (including steel tanks, steel vehicle chassis and aluminum armored personnel carriers) was conducted on previously unsurveyed and uncleared portions of the Range 44 pad (SCA 31) and at a smaller pad to the west of the Range 44 pad (SCA 30; Map 3 in Appendix A shows the locations of these SCAs). While processing began on asphalt, the heavy equipment, especially the tracked excavator, broke up the asphalt, and metal cuttings and debris were mixed with and crushed into the soil. In addition, so many targets were taken to the processing area that the pad could not contain them all, and some were placed within an area extending 30 ft east of the pad into Grid C2B9D3, which had been QA-accepted in Phase 1. This area, like the pads, was subject to QC and QA after target processing and MEC removal.

Cleanup that occurred after target processing operations was not part of the action recommended in the MRS-MOCO.2 Phase 1 TIP because the processing was not anticipated during MOCO.2 Phase 1. The work involved

1) Site preparation (excavation and sifting of soil),
2) Analog removal to depth,
3) DGM,
4) Digital excavation,
5) QC,
6) QA, and
7) Site restoration.

4.2.1 SITE PREPARATION

An excavator removed an approximately two-ft-thick layer of material from these two SCAs, which total close to 0.9 acres. An *in situ* volume of approximately 2,900 cubic yards of soil was then processed through a sifter with ¾-inch screen to remove any potential MEC. The soil that passed through the sifter was stockpiled while the munitions response process continued in the area from which the soil was removed.

4.2.2 ANALOG REMOVAL

Analog removal was performed in accordance with the procedures described in the MOCO.2 SSWP [Ref. 9] over the processing areas prior to replacing the sifted soil. Technicians used Schonstedt GA-52Cx magnetometers in three-ft-wide lanes to detect subsurface ferrous metal objects. Excavations at the locations of detected anomalies continued until the objects were removed or identified, with no maximum depth of investigation.

4.2.3 DIGITAL GEOPHYSICAL MAPPING

DGM was performed with a single, hand-pulled EM61-MK2 sensor over the processing areas prior to replacing the sifted soil. The EM61-MK2 data collected during the Phase 2 operations are shown on Map 4 (Appendix A). Chapter 3 describes the procedures used to select and reacquire anomalies found in the digital geophysical data.

4.2.4 DIGITAL EXCAVATION

Digital excavations were conducted in accordance with the MOCO.2 SSWP [Ref. 9]. The results from the 127 DGM anomaly excavations are summarized in section 5.3.3.

4.2.5 QUALITY CONTROL

Chapter 6 describes the three-step QC process for the MOCO.2 project. No significant metallic items were found during QC.

4.2.6 QUALITY ASSURANCE

Chapter 6 describes the USACE QA process for Phase 2 of the MOCO.2 project. The processing areas passed the QA inspection.

4.2.7 SITE RESTORATION

After the sifted soil was replaced in the processing areas, the area was graded and straw was crimped into the soil as an erosion control measure.

4.3 CULVERTS, PIPES, AND BURIED STEEL

While not specifically recommended by the MOCO.2 Phase 1 TIP because removing asphalt road was outside the original scope, removing culverts, pipes, and steel beneath and next to asphalt and concrete features allowed effective detection of potential MEC at those locations (see Photographs 8 and 9, Appendix C). Pierced-steel-plank (PSP) mat (SCA 21), culverts (SCAs 15 through 18), and steel pipe (SCAs 14 and 20) were removed using heavy equipment. Map 3 in Appendix A shows the location of these SCAs.

These features were in grids that had not passed Phase 1 QC/QA but instead had undergone removal operations and QC/QA up to the SCA boundaries and had then been assigned TBD status. This task originally included only the removal of these items, but because these items had been in asphalt areas or along the fence line before their removal, analog removal (except in SCA 9), DGM, digital excavation, QC, and QA were subsequently performed in these SCAs.

4.4 ASPHALT AND CONCRETE FEATURES

Seven areas were declared SCAs during Phase 1 due to the presence of asphalt pads (SCAs 10, 30, and 31; see Photograph 10 in Appendix C), asphalt roadways (SCA 9), concrete stairs (SCA 13), or concrete drainages (SCAs 12 and 19; see Photograph 11), which precluded the completion of removal actions during Phase 1. Map 3 in Appendix A shows the locations of these SCAs. (Section 4.6 also discusses SCA 10 because work there was concurrent with work on the adjacent fill area and firing positions, while Section 4.2 also discusses SCAs 30 and 31 because these areas were used as processing areas.) Tasks in these seven areas included

1) Site preparation,
2) Analog removal to depth (all except SCA 9 and its operational buffer),
3) DGM,
4) Excavating anomalies identified from the digital geophysical data,
5) Performing QC inspections, and
6) Performing QA inspections.

4.4.1 SITE PREPARATION

Metallic items were removed prior to collecting data over the areas. Three culverts, a section of reinforced concrete drainage, and PSP matting were removed from the Range 45 road and replaced with gravel. The reinforced concrete stairs (SCA 13) between the Range 45 road and pad and the reinforced drainage (SCAs 12 and 19) were removed. The debris piles located on asphalt-covered areas were removed prior to collecting digital geophysical data.

4.4.2 ANALOG REMOVAL

Analog removal was performed in accordance with the procedures described in the MOCO.2 SSWP [Ref. 9] for all asphalt- and concrete-related SCAs, except for SCA 9 (the Range 45 asphalt road) and its operational buffer, where magnetometers were less effective. Technicians operated Schonstedt GA-52Cx magnetometers along three-ft-wide lanes to detect subsurface ferrous metal objects. Excavations at the location of detected anomalies continued until the objects were removed or identified, with no maximum depth of investigation.

4.4.3 DIGITAL GEOPHYSICAL MAPPING

Because tests demonstrated that asphalt does not significantly affect the ability of the EM61-MK2 to detect subsurface metallic items, DGM was performed with a combination of the EM61-MK2 towed array and single, hand-pulled EM61-MK2 sensors over the asphalt-covered portions of the site. A white paper describing these tests is included as Appendix F. The results of the digital geophysical mapping in MOCO.2 confirmed the effectiveness of the EM61-MK2 for asphalt-covered areas. Based on this confirmation, only asphalt directly over detected metallic items was removed, leaving most of the paved range roads intact.

Because they contained steel reinforcement bars that interfere with EM61-MK2 operation, the concrete obstacles in SCAs 12, 13, and 19 were removed before performing DGM in these three areas.

The EM61-MK2 data collected during the Phase 2 operations are shown on Map 4 (Appendix A). Chapter 3 describes the procedures used to select and reacquire anomalies found in the digital geophysical data.

4.4.4 DIGITAL EXCAVATION

Digital excavations were conducted in accordance with the MOCO.2 SSWP [Ref. 9]. The results from the excavations are summarized in section 5.3.3.

4.4.5 QUALITY CONTROL

Chapter 6 describes the three-step QC process for the MOCO.2 project. No significant metallic items were found during this process.

4.4.6 QUALITY ASSURANCE

Chapter 6 describes the USACE QA process for Phase 2 of the MOCO.2 project. The SCAs with culvert, pipe, and buried steel passed the QA inspection.

4.5 RANGE 45 PAD, BERM, AND FIRING POSITIONS

The excavation of SCA 26 (Photograph 12), the berm / fill area immediately northwest of the Range 45 pad (characterized by steep terrain, timbers with metal bolts, and large anomalies requiring excavation with heavy equipment), was conducted concurrently with deconstruction (under the Ranges 43-48 scope of work) of the Range 45 pad (SCA 10, used as a target processing area) and firing positions (SCA 32) in MOCO.2 and Ranges 43-48. The fill area covered approximately 0.3 acres of steep terrain, and the Range 45 pad and firing positions consisted of approximately 1.8 additional acres. Map 3 in Appendix A shows the locations of these SCAs. This effort included

1) Site preparation (excavating and sifting the fill),
2) Analog removal to depth,
3) DGM,
4) Digital excavation,
5) QC,
6) QA, and
7) Site restoration.

4.5.1 SITE PREPARATION

Heavy equipment removed approximately 6,700 cubic yards (*in situ* volume) of material from the fill area, Range 45 pad, and Range 45 firing positions. This included

1) 1.0 acre of asphalt and underlying base layer excavated to an approximate depth of six to 12 inches at the former pad area (approximately 1,210 cubic yards),
2) 0.8 acres of soil excavated to an estimated depth of two feet (approximately 2,400 cubic yards) at the former firing positions, and
3) 0.3 acres of material excavated to a depth of between four ft and eight ft (approximately 3000 cubic yards) from the fill area northwest of the Range 45 pad.

The material scraped from the Range 45 pad, mostly asphalt and base layer, was relocated to and spread out on the Range 46 pad in MRS-15.SEA.4 for removal of any metallic materials mixed with the asphalt. The materials from the fill area and firing positions were processed through a sifter with ¾” screen to remove any potential MEC. The soil that passed through the sifter was stockpiled while the munitions response process continued on the surface from which the soil was removed.

4.5.2 ANALOG REMOVAL

Analog removal was performed in accordance with the procedures described in the MOCO.2 SSWP [Ref. 9] over the fill area (SCA 26) prior to replacing the sifted soil (SCAs 10 and 32 were done under the Ranges 43-48 interim action). Technicians operated Schonstedt GA-52Cx magnetometers along three-ft-wide lanes to detect subsurface ferrous metal objects. Excavations at the location of detected anomalies continued until the objects were removed or identified, with no maximum depth of investigation.

4.5.3 DIGITAL GEOPHYSICAL MAPPING

DGM was performed with a single, hand-pulled EM61-MK2 sensor over the fill area and the small portion of the Range 45 pad that falls within MOCO.2. The firing positions and the rest of the Range 45 pad were surveyed as part of the Ranges 43-48 munitions response project. The EM61-MK2 data collected during Phase 2 operations are shown on Map 4 (Appendix A). Chapter 3 describes the procedures used to select and reacquire anomalies found in the digital geophysical data.

4.5.4 DIGITAL EXCAVATION

Digital excavations were conducted in accordance with the MOCO.2 SSWP [Ref. 9]. The results from the excavations are summarized in section 5.3.3.

4.5.5 QUALITY CONTROL

Chapter 6 describes the three-step QC process for the MOCO.2 project. No significant metallic items were found during this process.

4.5.6 QUALITY ASSURANCE

Chapter 6 describes the USACE QA process for Phase 2 of the MOCO.2 project. The Range 45 pad, berm, and firing positions SCAs passed the QA inspection.

4.5.7 SITE RESTORATION

The sifted soil was replaced in approximately the original configuration. The area was graded, and straw was crimped into the soil as an erosion control measure.

4.6 MISCELLANEOUS AREAS (INCLUDING TRANSITE PIPE)

These areas included SCA 2, an anomaly on a steep hillside; SCAs 3 and 5, areas which previously contained surface metal; and SCA 4 (Photograph 13), an area where several transite (asbestos-containing) pipes were located after excavation at Ranges 45 and 44 during Phase 1 but had been removed to the Forward Landfill in Manteca, CA. In addition, about one cubic foot of asbestos-containing material was removed from the site and disposed in the Kettleman Hills Landfill in Kings County, CA prior to Phase 2 [Refs. 8, 10]. These areas total approximately 0.05 acres; Map 3 in Appendix A shows their locations. This task involved the following activities:

1) Analog removal to depth,
2) DGM,
3) Digital excavation,
4) QC, and
5) QA.

4.6.1 ANALOG REMOVAL

Analog removal was performed in accordance with the procedures described in the MOCO.2 SSWP [Ref. 9] over these areas. Technicians operated Schonstedt GA-52Cx magnetometers across three-ft-wide lanes to detect subsurface ferrous metal objects. Excavations at the location of detected anomalies continued until the objects were removed or identified, with no maximum depth of investigation.

4.6.2 DIGITAL GEOPHYSICAL MAPPING

DGM was performed over these areas with a single, hand-pulled EM61-MK2 sensor. The EM61-MK2 data collected during Phase 2 operations are shown on Map 4 (Appendix A). Chapter 3 describes the procedures used to select and reacquire anomalies found in the digital geophysical data.

4.6.3 DIGITAL EXCAVATION

Digital excavations were conducted in accordance with the MOCO.2 SSWP [Ref. 9]. The results from the excavations are summarized in section 5.3.3.

4.6.4 QUALITY CONTROL

Chapter 6 describes the three-step QC process for the MOCO.2 project. No significant metallic items were found during this process.

4.6.5 QUALITY ASSURANCE

Chapter 6 describes the USACE QA process for Phase 2 of the MOCO.2 project. The miscellaneous areas passed the QA inspection.

CHAPTER 5
PHASE 2 RESULTS

This chapter discusses the results of Phase 2 MEC removal operations, including DGM, QC, and QA. These operations took place in SCAs that were beyond the scope of Phase 1. For Phase 1 results, see the TIP reproduced in Appendix B. For more detail about QC and QA during Phase 2, see Chapter 6 of this AAR.

5.1 SITE PREPARATION RESULTS

As shown in Table 5-1, one MEC item was located during site preparation: an M74 series airburst projectile simulator from the Range 44 pad removal operation (SCA 31) was discovered while sorting scrap that did not pass though the sifting screen at SCA 26. This item was disposed of in accordance with PWP procedures [Ref. 2]. Map 5 shows the locations of MEC and MD-E removed during Phase 2, and Appendix G lists items encountered during Phase 2.

Table 5-1 — Summary of MEC Encountered during Site Preparation

Item Description	Qty	Location
M74 series airburst projectile simulator	1	SCA 31

5.2 ANALOG REMOVAL RESULTS

As shown in Table 5-2, the analog removal process discovered three MEC items: one M74 series airburst projectile simulator in SCA 17 and two M744 22mm subcaliber practice projectiles in SCA 26. These items were also disposed of in accordance with PWP procedures [Ref. 2]. Map 5 shows the locations of MEC and MD-E removed during Phase 2, and Appendix G lists items encountered during Phase 2.

Table 5-2 — Summary of MEC Encountered during Analog Removal

Item Description	Qty	Location
M74 series airburst projectile simulator	1	SCA 17
M744 22mm subcaliber practice projectiles	2	SCA 26

5.3 DIGITAL GEOPHYSICAL RESULTS

5.3.1 DATA ACQUISITION

The anomaly selection process resulted in 631 anomalies, including 575 single-point anomalies and 56 larger anomalies designated as digital geophysical polygons because the data processors could not discern individual anomalies in the data.

Table 5-3 shows the breakdown of anomalies by SCA type. Anomalies identified over culverts and pipes were classified as “Asphalt and Concrete” because the culverts had been removed at the time of the digital geophysical data acquisition and the anomalies were located in or near asphalt roadways.

Table 5-3 — Anomalies by SCA Type

SCA Type	Anomalies Selected	Anomalies Successfully Reacquired	Anomalies Excavated as QC of Reacquisition
Asphalt and Concrete	349	289	19
Berms	22	20	1
Fence	150	109	18
Miscellaneous	3	3	0
Processing	83	67	5
Range 45	24	20	2
Total	631	508	45

5.3.2 REACQUISITION

Of the 631 anomalies, 508 were successfully reacquired, including all 56 digital geophysical polygon anomalies. The reacquisition teams found no anomaly meeting the 3-mV anomaly selection threshold at the remaining 123 anomalies. Most of these anomalies were likely background noise recorded during the initial survey. This rate is typical at Fort Ord when using a threshold just above the background noise level. Excavation teams investigated 45 of the 123 unsuccessfully reacquired anomalies as a quality control measure for the reacquisition process; the investigations found no MEC or expended munitions debris.

5.3.3 DIGITAL EXCAVATION RESULTS

The 508 successfully reacquired anomalies and 45 anomalies selected for QC of the reacquisition process were excavated. No MEC items were found during this process. Table 5-4 includes the weights of munitions debris and range-related debris found during the digital excavation process in each type of SCA. Digital excavations in culverts and pipes SCAs were classified as "Asphalt and Concrete" because the culverts had been removed at the time of the digital geophysical data acquisition and the anomalies were located in or near asphalt roadways.

Table 5-4 — Digital Excavation Results

SCA Type	Munitions Debris (pounds)	Range-Related Debris (pounds)
Asphalt and Concrete	1	1157.1
Berms	1.25	37.7
Fence	16.05	439.92
Misc	0	1
Processing	2.1	284.3
Range 45	4.15	15.95
Total	24.55	1935.97

In some cases, a polygon anomaly investigation could not be completed because an obstruction interfered with geophysical instruments, resulting in an SCA. If the UXO technicians found any sources (MEC, munitions debris, or range-related debris) before such interference put the area out of scope, the results were entered into the database and appear in Appendix H. If no sources were found before proximity to the obstruction interfered with instrument operation, then there was no information to enter into the database, and therefore no entry in Appendix H.

Appendix H includes the intrusive investigation results in tabular form as well as color contour maps showing the processed digital geophysical data and the 631 anomaly locations (Maps H-1 through H-22). These maps divide the removal area into smaller sets of grids, shown in this series of 11-inch-by-17-inch pages. Appendix I includes the traverse line maps from the digital mapping surveys, showing the actual paths covered by the geophysical surveys.

5.3.4 QC OF DIGITAL GEOPHYSICAL OPERATIONS

Parsons' QC and project geophysicists monitored the digital geophysical fieldwork and data management to ensure that activities complied with all work plans and procedures. They reviewed field forms, reacquisition results, QC-1 results, and digital geophysical data deliverables. The following sections summarize the QC activities conducted during the data acquisition, data processing, and anomaly reacquisition procedures; Section 5.16 of the PWP details each of these QC activities [Ref. 2].

5.3.4.1 Data Acquisition

Parsons QC personnel observed the data acquisition process during periodic field audits to ensure that the team was performing the following activities:

- Conducting static instrument tests with the geophysical instruments (FVF PWP015);
- Conducting GPS position tests;
- Conducting instrument lag tests;
- Conducting standardization tests with the geophysical instruments;
- Using appropriate measures to ensure sufficient data coverage (e.g., using visible markers to guide the operator along profiles separated by the appropriate line spacing of 2 ft);
- Checking the quality of the GPS signal to ensure sufficiently accurate position information;
- Using the appropriate data collection rate (10 samples/second with operator-pulled system; 12 samples/second with towed array);
- Checking the transfer of GPS information into the instrument data loggers;
- Backing up the field forms on the PDA; and
- Reviewing data acquisition field forms for accuracy and completeness prior to data processing.

5.3.4.2 Data Processing

The Parsons QC geophysicist or a data processor who did not process the data performed QC checks on all raw and processed data deliveries.

The following aspects of the raw data deliveries were checked to ensure that they complied with data quality objectives (DQOs) and the project objectives described in the PWP and MRS-MOCO.2 SSWP [Refs. 2 and 9]:

- Coordinate system and format;
- Survey coverage;
- Background noise levels;
- Down line data density; and
- Data file format and headers.

In addition to these items, processed data deliveries were also checked for anomaly selections, and the effects of all processing steps were applied to the raw data to ensure that they conformed to the DQOs described in the PWP and MRS-MOCO.2 SSWP [Refs. 2 and 9].

5.3.4.3 Anomaly Reacquisition

The Parsons QC geophysicist observed the anomaly reacquisition process during periodic field audits to ensure that the team was performing the following activities:

- Using the same digital instrument used for the initial survey;
- Nulling the instrument periodically (EM61-MK2 only) to keep background responses at approximately 0mV and to allow the reacquisition team to accurately report instrument response to an anomaly ;
- Moving pin flags to the peak of the anomaly;
- Recording the reacquisition results and the distance and direction that flags were moved;
- Checking the quality of the GPS signal to ensure that the positioning information was sufficiently accurate;
- Storing the position of flags located with the GPS; and
- Backing up the reacquisition results on the PDA.

After the PDAs were synchronized, the reacquisition results and occupied positions were compared with the initial survey data and anomaly selections. Parsons' QC geophysicist rechecked those anomalies that were significant during the initial survey but were not successfully reacquired. The positions stored by the reacquisition team were compared with the anomaly coordinates initially selected from the initial data; all discrepancies of two ft or greater were investigated further by the Parsons QC or project geophysicist.

CHAPTER 6
PHASE 2 QUALITY CONTROL AND QUALITY ASSURANCE

This chapter describes the QC/QA process for Phase 2. The Phase 1 TIP (Appendix B of this AAR) provides a detailed account of the three checks of fieldwork during Phase 1: QC-1 (digitally checking and reinvestigating, if needed, excavations of anomalies detected during digital mapping, QC-2 (performing a digital step-down QC survey with the same instrument type used for the initial survey), and QC-3 (performing a 10% analog QC survey with a Schonstedt magnetometer). The TIP also describes QA performed by the USACE. During Phase 1, grids with SCAs received QC and QA up to or around the SCA but were not accepted (were placed in TBD or SCA status) until completion of Phase 2.

The QC process for the MRS-MOCO.2 SCA Phase 2 NTCRA involved QC-1, QC-2, and QC-3 of SCAs, where possible. When the SCAs in a grid passed Phase 2 QC/QA, the process was complete for the entire grid, and the government accepted that grid.

During the QC/QA inspections reinvestigation, if an MEC or MEC-like item large enough to represent a 37mm projectile (or larger) was encountered, the QC/QA inspectors failed the grid where the item was found. This pass-fail criterion was based on the smallest target MEC expected in the area. Any grid failure or any other QC issue was addressed by a nonconformance report (NCR), which describes the issue, lists the cause, and recommends a corrective action. The sole NCR from this NTCRA is included as Appendix J.

6.1 QC-1: DIGITAL CHECK OF EXCAVATIONS

Parsons geophysical teams checked anomaly locations excavated during the digital mapping operations to ensure that the sources of the anomalies were satisfactorily removed. The area within at least a three-ft radius of each excavated anomaly was inspected with the same digital instrument type used for the initial survey, and the maximum amplitude response indicated by the instrument was recorded and checked against the original amplitude of the excavated anomaly. If the source of the anomaly had not been removed, Parsons' quality control manager (QCM) and UXO QC specialist (UXOQCS) intrusively reinvestigated the anomaly.

Seventy-eight anomaly excavations required reinvestigation, but only fragments of munitions debris, range-related debris, and hot rocks were found. Of the 78 anomalies investigated, one, C2C7A8-P2-0002, resulted in an NCR being issued (Appendix J). Appendix K lists the QC-1 reinvestigation results.

6.2 QC-2: DIGITAL SURVEY

The Parsons QC geophysical teams digitally surveyed a minimum of 10% of each SCA in the 102 grids or partial grids affected by SCAs (the 96 that were accepted following Phase 2 work plus the six receiving TBD status due to the presence of latrine pits or utility poles that could not be removed within the time and funding constraints of the SOW), using an EM-61 MKII magnetometer.

The anomaly selection process resulted in 60 anomalies requiring investigation. Map K-1 (Appendix K) shows the results of the QC-2 survey. Maps K-2 through K-23 show the processed QC-2 geophysical data and the 58 anomalies selected for investigation. Appendix L presents the traverse line maps from the QC-2 digital mapping survey, showing the actual paths covered by the QC survey personnel.

6.2.1 REACQUISITION AND INTRUSIVE INVESTIGATION RESULTS

Of the 60 anomaly locations identified by the QC-2 survey, 50 were successfully reacquired. Parsons UXOQC personnel excavated 58 anomalies: the 50 successfully reacquired anomalies and eight of the ten unsuccessfully reacquired anomalies (80%).

Of the 102 grids or partial grids that were determined in Phase 1 to be SCAs, three grids contained utility poles and pole anchors (Photograph 14), two contained a latrine spanning their border, and one contained another latrine. All six were assigned TBD or “construction support" status, meaning that if intrusive work is done in the SCA, such work should first be supported by removal of the obstacles followed by analog removal and digital geophysical operations. The QC anomaly excavations produced 5.8 pounds of munitions debris and 10.7 pounds of range-related debris; no MEC were encountered. The breakdown of the 58 anomaly excavations is as follows:

- Approximately 78% of the anomalies were range-related debris.
- Approximately 10% were munitions debris.
- Approximately 12% indicated false positives.

Figure 6-1 displays the QC-2 anomaly excavation results, and Appendix K shows the results of the QC-2 anomaly excavations.

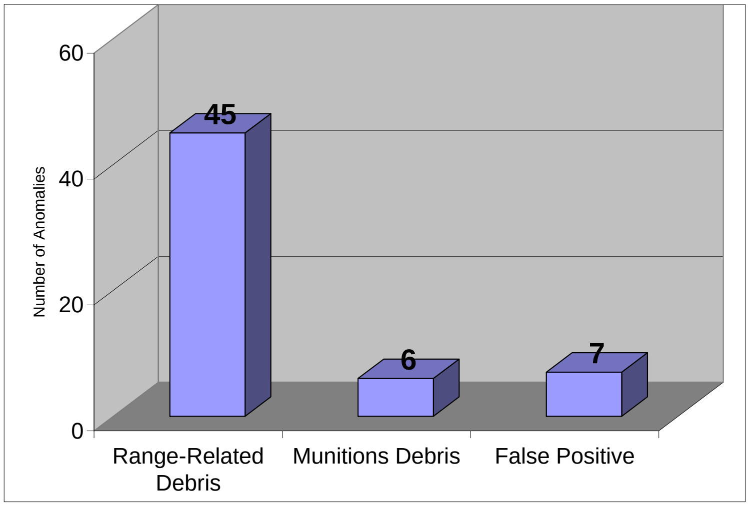

Figure 6-1 — QC-2 Survey Anomaly Excavation Results

6.3 QC-3: ANALOG 10% SURVEY

During Phase 2, Parsons UXOQC personnel inspected 10% of 65 grids with Schonstedt magnetometers. The remaining 37 grids consisted of asphalt and could not be surveyed with this instrument; therefore, the digital QC2 survey was the final QC process on those 37 grids.

No MEC or MEC-like items were found in the 65 grids/partial grids.

The Parsons UXOQCS passed the 62 grids where the analog removal and digital mapping were completed. The other three grids, which contain utility poles and pole anchors, were assigned construction support status. QC operations in these grids were performed to within approximately six ft of the poles and anchors. Appendix K lists the results of the QC-3 analog inspection.

6.4 QUALITY ASSURANCE

6.4.1 ANALOG QA SURVEY

Using a Schonstedt GA-52Cx magnetometer, USACE QA personnel rechecked at least 10% each of the 62 grids passed by Parsons UXOQC during Phase 2 and found no MEC. The USACE UXO safety specialist accompanied the Parsons' QC personnel during the QC-2 process to provide QA for the 37 grids that contained asphalt and could not be surveyed with the Schonstedt magnetometer. Appendix M contains electronic copies of the USACE Sacramento District quality assurance memos for the grids accepted in Phase 2; the originals are signed. Map 6 shows the QA acceptance status of the grids in MRS-MOCO.2 following Phase 2.

CHAPTER 7
VARIATIONS FROM SSWP

7.1 PHASE 1

Chapter 7 of the Phase 1 TIP, in Appendix B of this AAR, discusses the changes to the procedures outlined in the MRS-MOCO.2 SSWP [Ref. 9], referencing the three FVFs that modified the MRS-MOCO.2 SSWP to increase the exclusion zone after finding two 75mm high-explosive MK1 projectiles, allow use of the EM61-MK2 in more areas, and reduce unnecessary replication of survey lines when digital geophysical operations follow analog removal.

7.2 PHASE 2

FVF MOCO2-0002 made one additional change to the EM61-MK2 static test criteria for the Phase 2 work (Appendix D). During Phase 1 activities, the G858 magnetometer was used along the portions of the fence line within 200 ft of the power lines that run north of the site because the EM61-MK2 was more affected by electromagnetic noise from those lines and would not meet the static noise level criteria of 2.5mV. However, the EM61-MK2 towed array system was used for the geophysical mapping over the entire fence line during Phase 2 because

1) It is not affected by the magnetic anomalies from pieces of asphalt that have broken off Eucalyptus Road,
2) The noise level increase caused by the power lines raised the static noise levels from approximately 1.5mV to approximately 2.5mV, not enough to significantly raise the false alarm rate or interfere with anomalies from deeper metallic objects, and
3) The data can be collected more efficiently with the towed array system.

CHAPTER 8
LESSONS LEARNED

8.1 PHASE 1

One lesson learned during Phase 1 of the MOCO.2 TCRA was that using analog removal followed by digital mapping provides more thorough MEC detection than by using the single most appropriate technology (as at earlier sites), and does so at a similar cost.

Fieldwork also showed that individually operated digital instruments were more efficient than towed arrays for surveying densely treed areas.

Also, if anomaly density or depth at a particular location requires backhoe excavations that cannot be completed before digital mapping, the location should be recorded using GPS to prevent using digital mapping to select anomalies from there for reacquisition, since the anomalies will be excavated when the backhoe excavates that area, and attempting to perform digital excavation in that location would be redundant and inefficient. Chapter 8 of the Phase 1 TIP discusses these lessons (Appendix B of this AAR).

8.2 PHASE 2

Observations during operations at the MRS-MOCO.2 and MRS-SEA.1-4 indicated that the EM61-MK2 could be effectively used on paved areas. In late 2004, the EM61-MK2 was tested over a 40-ft-by-40-ft grid in the northeast corner of the Parsons compound parking lot at the former Fort Ord. Three inert 37mm projectiles were buried under existing 3-inch-thick asphalt paving, and three were buried in an adjacent dirt area. An EM61-MK2 cart was pushed over the test grid to collect three sets of geophysical data: a control set before the items were buried, a second set with the items buried 12 inches below ground surface (bgs), and a third set with the test items buried 18 inches bgs. The asphalt did not significantly affect the ability of the EM61-MK2 to detect subsurface metallic items. See Appendix F for a more detailed discussion.

CHAPTER 9
COST AND ACCIDENT EXPOSURE DATA

9.1 COST DATA

The operations described by this document were performed and associated costs incurred under Task Order 0004, Contract DACA05-00-D-0003. Table 9-1 shows the breakdown of the manhours and associated costs (by work breakdown structure [WBS] element) for the Phase 1 operations of the MRS-MOCO.2 NTCRA, and Table 9-2 shows the breakdown for Phase 2.

Table 9-1 — Hours Spent and Cost of Operations for MRS-MOCO.2 NTCRA Phase 1

WBS Code	WBS Element	Hours	Cost
1.3.06.3	SSWP	289.0	$17,762
1.3.06.4	GIS	234.1	13,711
1.3.06.5.1	Location survey mapping	100.0	10,247
1.3.06.5.2	Site preparation and restoration	7.0	12,729
1.3.06.5.3	Geophysical Survey	1108.5	98,625
1.3.06.5.4	UXO removal	5796.0	419,362
1.3.06.5.5	QC	—[a]	24,175
1.3.06.5.6	MPPEH Management and Removal	—[b]	2,196
1.3.06.5.7	Site security	—[a]	—[a]
1.3.06.5.8	Management and Support	1579.8	98,639
1.3.06.6	TIP	464.5	25,149
Total		9578.9	$722,595

[a]Data not yet available
[b]Operations recorded by pound

Table 9-2 — Hours Spent and Cost of Operations for MRS-MOCO.2 NTCRA Phase 2

WBS Code	WBS Element	Hours	Cost
1.3.39.4	MOCO.2 SCA: GIS	449	$30,595
1.3.39.5.01	MOCO.2 SCA: fence	550	$76,444
1.3.39.5.02	MOCO.2 SCA: asphalt/concrete features	324	$45,913
1.3.39.5.03	MOCO.2 SCA: berms	331	$46,542
1.3.39.5.04	MOCO.2 SCA: culverts	218	$32,039
1.3.39.5.05	MOCO.2 SCA: QC	149	$9,055
1.3.39.5.06	MOCO.2 SCA: Range 44 pad	550	$65,533
1.3.39.5.07	MOCO.2 SCA: miscellaneous areas	158	$15,990
1.3.39.5.08	MOCO.2 SCA: site specific mgmt	142	$10,469
1.3.39.6	MOCO.2 SCA: after action report	552	$41,151
Total		3,423	$373,731

9.2 ACCIDENT EXPOSURE DATA

There were no recordable accidents or injuries associated with the supplemental work performed on MRS-MOCO.2.

CHAPTER 10
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

10.1 SUMMARY

To address the threat posed to human health (public safety) or welfare or the environment by the MEC known to exist on or near the surface of MRS-MOCO.2, the Army conducted an NTCRA on the 33-acre northern portion of the site. Phases 1 and 2 of the NTCRA both involved three major activities:

1) Performing analog removal with Schonstedt GA-52Cx magnetometers;
2) Digitally mapping the post-removal site conditions by geophysically surveying the site, then investigating and resolving any anomalies detected by the survey; and
3) Conducting QC/QA inspections.

10.1.1 SUMMARY OF PHASE 1

10.1.1.1 Analog Removal

UXO teams used Schonstedt magnetometers to detect subsurface anomalies and excavated all detected anomalies until removing their sources. The analog removal produced 551 MEC items, including five high explosive (HE) items, and 1,493 pounds of munitions debris. Most of the MEC recovered during the analog removal were hand grenade fuzes, most of them in military munitions burial sites. Twenty-one such sites were found in 15 grids, containing mostly hand grenade fuzes and .30-caliber cartridges.

The UXO teams recovered 32 of the 33 inert, blue-painted ordnance items seeded by Parsons UXOQC personnel before the analog removal. The one QC item not recovered, a MKII practice hand grenade, was buried near the maximum detection depth of the Schonstedt magnetometer for that item. The UXO teams also recovered 19 of the 20 QA items seeded by the government (steel rebar similar in shape to a 37mm projectile). The one QA item not recovered, an unthreaded steel bar, was smaller in diameter than the 37mm projectile it was meant to represent and was deeply buried for its size.

Approximately 18% (six acres) of the site was designated as SCAs during Phase 1 because obstructions compromised instrument performance or technician safety. These SCAs were addressed during Phase 2 of this NTCRA.

10.1.1.2 Digital Mapping

A combination of individually operated and towed array EM61-MK2 electromagnetic metal detectors and G-858 magnetometers were used to map the post-removal site conditions. The digital mapping indicated 1,326 anomaly locations requiring investigation. After verifying whether the areas were anomalous, the UXO teams excavated 1,210 anomalies.

The anomaly excavations produced seven MEC items, 43 pounds of munitions debris, and 331 pounds of range-related debris. Of the seven MEC items encountered, two (an illumination signal and a MKII practice hand grenade) should have been detected and excavated during the analog removal because of their ferrous content and relatively shallow depths. Their recovery during the digital mapping process further supports the use of analog and digital instruments together to improve the effectiveness of munitions responses to MEC at similar sites on the former Fort Ord.

Before the digital geophysical survey, the Parsons UXOQCS reburied 33 inert, blue-painted ordnance items in the same locations that the items were seeded before the analog removal. In addition, they buried an inert grenade at the location where an analog removal team had missed an item. The UXO teams recovered all 34 QC items.

Two QA seed items representing 37mm projectiles, a small steel bar and a section of threaded rod, were not recovered. The small steel bar was significantly smaller in diameter than 37mm. The threaded rod was tested after the survey by placing it next to an EM61-MK2 and did not produce an anomalous response; that is, the instrument did not detect its presence, likely due to the rod's manufacturing process. This makes the threaded rod unrepresentative of the 37mm projectile that it was intended to simulate.

10.1.1.3 QC/QA

QC inspections of the MOCO.2 NOI removal area consisted of rechecking each anomaly excavation (QC-1); digitally resurveying a portion of each grid (QC-2); and checking at least 10% of each grid with a Schonstedt magnetometer (QC-3). QA checks entailed performing both an analog survey of at least 10% on each grid and digital survey of 5% of the site.

10.1.1.3.1 QC-1

All the excavations in the MRS-MOCO.2 removal area passed the QC-1 inspection. Only fragments of munitions debris, range-related debris, and hot rocks were found in the 62 anomaly excavations required reinvestigation; no MEC were encountered.

10.1.1.3.2 QC-2

A portion of each grid was resurveyed with the same instrument type used for the initial survey. The QC-2 survey indicated 229 anomalies, of which 209 were excavated. The anomaly excavations produced 0.5 pounds of munitions debris and 47 pounds of range-related debris; no MEC were encountered. Of the 195 grids/partial grids, 194 passed the QC-2 inspection. The one grid failure resulted from a five-inch-long pipe found in a grid located next to an area consisting of heavy debris and construction material. The recommended corrective action for grid failure (complete anomaly excavations requiring a backhoe and reperforming the analog removal over the entire failed grid) was determined to be unnecessary because most of the grid is an SCA.

10.1.1.3.3 QC-3

Parsons UXOQC checked at least 10% of all 195 grids/partial grids with a Schonstedt magnetometer, encountering no MEC. During QC-3, a five-inch-long, pipe-like object was found underneath a tree's canopy, resulting in a grid failure. Although this area could not be subjected to the digital mapping process because of the tree, the object found should have been recovered during the analog removal due to its size. The recommended corrective action for this grid failure (reperforming the analog removal on the failed grid) was determined unnecessary because most of the grid is an SCA and the entire non-SCA portion of the grid had already been checked during the analog QC-3 inspection.

Parsons' UXOQC passed the 99 grids where the analog removal and digital mapping were completed. The other 96 grids contained SCAs, which were addressed in Phase 2.

10.1.1.3.4 QA

The government rechecked at least 10% of the 99 grids passed by Parsons' UXOQC with a Schonstedt magnetometer and found no MEC. The government also conducted an independent digital survey over 100% of eight grids (approximately 5% of the site), and found no MEC.

10.1.2 SUMMARY OF PHASE 2

One MEC item, an M74 airburst projectile simulator, was found while sifting scrap at SCA 26 from the Range 44 pad removal operation (SCA 31) during site preparation of the SCAs. This item was disposed of in accordance with PWP procedures [Ref. 2].

10.1.2.1 Analog Removal

As in Phase 1, UXO teams used Schonstedt magnetometers to detect subsurface anomalies and excavated all detected anomalies until removing their sources. Analog investigation of the SCAs resulted in acquisition and removal of three MEC items: two M744 22mm subcaliber practice projectiles and one M74 airburst projectile simulator. These items were also disposed of in accordance with PWP procedures [Ref. 2].

10.1.2.2 Digital Mapping

Phase 2 field activities addressed the recommendations in the MRS-MOCO.2 TIP. Individually operated and towed array EM61-MK2 electromagnetic metal detectors were used to map the post-removal site conditions. The anomaly selection process following digital geophysical surveys resulted in selection of 631 anomalies for intrusive investigation, including 575 single-point anomalies and 56 larger anomalies designated as digital geophysical polygons because the data processors could not discern individual anomalies from the data. Of the 631 anomalies, 508 were successfully reacquired; all 56 digital geophysical polygon anomalies were successfully reacquired. The successfully reacquired anomalies and 45 anomalies selected for QC of the reacquisition process were excavated. No MEC items were found during this process, although 24 pounds of munitions debris and 1,936 pounds of range-related debris were excavated.

Parsons' QC and project geophysicists monitored the digital geophysical fieldwork and data management to ensure that activities complied with all work plans and procedures. They reviewed field forms, reacquisition results, QC-1 results, and digital geophysical data deliverables.

10.1.2.3 QC/QA

Where possible, the three-step QC process applied during the Phase 1 activities (QC-1, QC-2, and QC-3) was also used during Phase 2. No MEC or significant metallic items were found during the Phase 2 QC process, only fragments of munitions debris, range-related debris, and hot rocks. One of the anomalies investigated during Phase 1 resulted in an NCR; the grid was passed after corrective action. There were no grid failures during QC-2 or QC-3

The government rechecked at least 10% each of the grids passed by Parsons UXOQC with a Schonstedt magnetometer and found no MEC. The USACE UXO safety specialist accompanied the Parsons QC personnel during the QC-2 process to provide QA for the 37 grids that contained asphalt and could not be surveyed with the Schonstedt magnetometer.

10.2 CONCLUSION

The cleanup operations specified in the approved MRS-MOCO.2 SSWP [Ref. 9] have been completed in all areas of the MRS-MOCO.2 NOI removal area, except at the two latrines and within six feet of certain utility poles and anchors in three grids, to the maximum capability of the technologies and instruments used. Based on the results of this NTCRA, the threat to the public and the environment posed by the presence of MEC on the 33-acre northern portion of MRS-MOCO.2 has been mitigated.

Schonstedt magnetometers were used for analog detection of subsurface anomalies during both phases, and all anomalies detected were excavated until their sources were removed. After the analog removal in each area of MRS-MOCO.2, the area was digitally mapped and all anomalies potentially representing MEC in the subsurface were intrusively investigated. During Phase 1, subsurface MEC was removed from most of the NOI removal area, except for approximately six acres designated as SCAs because obstructions compromised instrument performance or technician safety. The immediate threat posed to the public by MEC within these SCAs had been mitigated by removal of the MEC on the surface. Phase 2 of this NTCRA addressed the subsurface MEC in the SCAs, implementing the cleanup solutions recommended in Section 11.3 of the Phase 1 TIP.

Digital and analog QC inspections were then conducted, using the same type of digital instrument that was initially used; no MEC were found during QC. Analog and digital QA inspections followed the QC inspections. All 99 grids inspected during Phase 1 passed inspection. During Phase 2, three grids with utility poles and pole anchors and three grids with latrine remnants were assigned TBD status; the 99 other grids passed the three-stage QC process. QC operations in the six grids with obstacles were performed to within approximately six ft of the obstacles. The government accepted all 99 girds that passed QC.

10.3 RECOMMENDATIONS

10.3.1 PHASE 1

The Phase 1 TIP called for subsurface removal on the portions of the MRS-MOCO.2 NOI removal area designated as SCAs, recommending specific actions for the various types of obstacles, including fences, structures, debris piles, asphalt- and concrete-covered areas, berms, fills, and asbestos pipes. Phase 2 addressed those areas containing the obstacles.

10.3.2 PHASE 2

Reasonable and prudent precautions should be taken when intrusive operations are conducted in the MRS-MOCO.2 NOI removal area because the complete removal of MEC from any given area cannot be guaranteed. In addition, construction support should be provided during intrusive operations in the grids containing non-resolved SCAs, and all personnel involved with intrusive operations throughout the MRS-MOCO.2 NOI removal area should receive MEC recognition training. The MRS-MOCO.2 NOI removal area will be evaluated at a later date in the Fort Ord Munitions Response Remedial Investigation and Feasibility Study.

In future subsurface MEC removal actions at the former Fort Ord, EM61-MK2 electromagnetic sensors should be used for digital mapping of large areas of asphalt. The asphalt areas should be subjected to the site's QC seeding program to ensure that different characteristics of the asphalt, such as thickness or composition, do not reduce the ability of the EM61-MK2 to detect metallic items under the asphalt. This recommendation is limited to MRSs at the former Fort Ord because asphalt areas at other sites would probably have different composition that could cause different outcomes. A separate asphalt test, similar to the one described in Appendix F, should be conducted for each site where asphalt areas are to be digitally mapped.

CHAPTER 11
REFERENCES

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